

1    **CLAIMS:**

2    1. A protective helmet providing at least one illuminating LED  
3    array, including a circuit driven by at least one battery for  
4    powering amplifying means to drive the array, the circuit  
5    comprising: a comparator, the battery providing an input voltage  
6    and a reference voltage for the comparator, the comparator being  
7    turned on when the input voltage exceeds the reference voltage,  
8    a semiconductor device actuated by the comparator, and  
9    functioning as a shunt to maintain the load voltage constant for  
10   voltage/current variations as the battery is worn down, and  
11   amplifiers connected to the battery, semiconductor device and  
12   comparator for turning on the LED array.

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14   2. The helmet of Claim 1, in which the comparator is an  
15   operational amplifier, the semiconductor device is a Zener diode,  
16   and the amplifiers are transistors.

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18   3. The helmet of Claim 2, in which input voltage is supplied to  
19   the comparator through a voltage divider.

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21   4. The helmet of Claim 2, in which batteries provide about 6600  
22   milliamps @ 7.2 volts, and the LED array provides about 4000 MCD  
23   @ about 20 milliamps for about 5 - 5 1/2 hours for about 93 LEDs  
24   in the arrays.

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1 5. The helmet of Claim 2, in which the zener diode is operated  
2 in the reverse conduction condition to reduce ripple voltage.  
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4 6. The helmet of Claim 2, comprising an inner component of  
5 resilient material, and central and outer components of a hard  
6 material, the components being secured together, and at least one  
7 LED array mounted in at least one of the central and outer  
8 components.  
9  
10 7. The helmet of Claim 6, in which the resilient material is  
11 constructed as a foam.  
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13 8. The helmet of Claim 6, in which the central and outer  
14 components are integrally formed of plastic material, at least  
15 one of the said components providing a centrally disposed  
16 reinforcing grid, and one or more batteries being secured in the  
17 reinforcing grid when the central and outer components are joined  
18 together.  
19  
20 9. The helmet of Claim 2, in which components of the circuit  
21 are mounted on a circuit board secured by the helmets, and two  
22 batteries are employed for respective input and reference  
23 voltages, the batteries being isolated from each other by a  
24 diode.  
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1 10. The helmet of Claim 1, the batteries being removable,  
2 rechargeable, or both.

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4 11. A method for providing a helmet with at least one  
5 illuminating LED array, which comprises incorporating a circuit  
6 into the helmet, the circuit including: at least one battery for  
7 powering amplifying means to drive the array, the circuit  
8 comprising: a comparator, the battery providing an input voltage  
9 and a reference voltage for the comparator, the comparator being  
10 turned on when the input voltage exceeds the reference voltage,  
11 a semiconductor device actuated by the comparator, and  
12 functioning as a shunt to maintain the load voltage constant for  
13 voltage/current variations as the battery is worn down, and  
14 amplifiers connected to the battery, semiconductor device and  
15 comparator for turning on the LED array.

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17 12. The method of claim 11, in which the comparator is an  
18 operational amplifier, the semiconductor device is a Zener diode,  
19 and the amplifiers are transistors.

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21 13. The helmet of Claim 12, in which input voltage is supplied  
22 to the comparator through a voltage divider.

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1   **14.**   The helmet of Claim 12, in which batteries provide about  
2   6600 milliamps @ 7.2 volts, and the LED array provides about 4000  
3   MCD @ about 20 milliamps for about 5 - 5 1/2 hours for about 93  
4   LEDs in the arrays.

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6   **15.**   The method of Claim 12, in which the Zener diode is operated  
7   in the reverse conduction condition to reduce ripple voltage.

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9   **16.**   The method of Claim 2, comprising an inner component of  
10   resilient material, and central and outer components of a hard  
11   material, the components being secured together, and an LED array  
12   is mounted in at least one of the central and outer components.

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14   **17.**   The method of Claim 16, in which the resilient material is  
15   constructed as a foam.

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17   **18.**   The method of Claim 16, in which the central and outer  
18   components are integrally formed of plastic material and provide  
19   at least one centrally disposed reinforcing grid, and batteries  
20   being secured in the reinforcing grid when the central and outer  
21   components are joined together.

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1 19. The method of Claim 12, in which components of the circuit  
2 are mounted on a circuit board secured by the helmets, and two  
3 batteries are separately employed for respective input and  
4 reference voltages.

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6 20. The method of Claim 11, in which the batteries are operated  
7 as being removable and rechargeable.